

REMARKS

Claims 1-22, all the claims pending in the application, are rejected. Claims 2-12, 14-19 and 22 are amended. In particular, claim 15 is placed into independent form and the subject matter of claims 20 and 21 are incorporated therein. Claims 2-12 and 14 are amended to conform the claims to the method invention that now is the focus of all the pending claims. All remaining claims are amended to remove reference characters and to improve grammar and style. Claims 1, 13, 20 and 21 are cancelled. New claim 23 is added.

Claim Objections

The Examiner objects to claim 8 because it recites the limitation "the bead" in lines 2, 3. There is insufficient antecedent basis for this limitation in the claim. This basis for objection has been removed by amendment of the claim.

Claim Rejections - 35 USC § 102

Claims 1, 2, 7, 9-13, 15 and 18-21 are rejected under 35 U.S.C. 102(b) as being anticipated by Mertz (WO01/98020). This rejection is traversed for at least the following reasons.

As a preliminary matter, with regard to claims 1, 13, 20 and 21, the rejection is moot in view of the cancellation of these claims.

Claim 15

Claim 15 has been amended to place the claim into independent form and to add the limitations of claims 20 and 21. Applicants submit that the claimed method With regard to claim 15, the Examiner asserts that Mertz discloses a method for producing a camshaft substantially as claimed, with reference to Fig. 1. With regard to claim 20, the Examiner asserts that Mertz in Fig. 4 discloses an additional forming step that provides the impression of an indentation, whereby material is transported outward in the axial direction in the region of the elevation of the cam and is heaped up there in such a way that the finished cam encloses the shaft with an angle of enclosure of 360 (see figure 4). With regard to claim 21, the Examiner asserts that Mertz discloses in Fig. 2 that the additional forming step is performed after the elevation of the cam has been configured by forming methods.

Merz

Applicants respectfully submit that Merz does not disclose the method as defined by amended claim 15, and as supported by the original disclosure in Figures 15-24 and the specification at page 14, line 32 to page 16, line 31. In particular, Merz does not teach the particularly advantageous method for producing a built-up camshaft, in which a cam having an angle of enclosure of 360° is created from a flat profile strip of constant thickness by multiple bending/forming steps, followed by welding. In particular, Merz does not teach achievement of a full 360° angle of enclosure by use of an additional forming process, wherein cam material is displaced from the region beneath the elevation 49 and forced axially outward in order to fill the cavity between cam and shaft and boost the angle enclosure to 360°. This distinction can be appreciated on the basis of Applicant's disclosed comparison of the admitted prior art and the invention.

The prior art method

As outlined in the specification, page 12, line 12 to page 13, line 11, the first forming step shown in figure 7, as well as the second forming step shown in figure 8, and the welding step shown in figure 9, are already known from the prior art. The disadvantage of this prior art method is the formation of a cavity 33 beneath the elevation 49 of the cam 30 (figure 11). Due to this cavity 33, the angle of enclosure UW is significantly less than 360° (figure 10).

The present invention

The prior art method shown in figures 7-10 is the starting point of the present invention, and the object of the invention is to increase the angle of enclosure to 360°.

According to the present invention, the object is achieved with an additional forming step, as shown in Figures 17 and 19. This additional forming step is carried out between the forming step shown in Figure 16 (and corresponding to the prior art first forming step shown in Figure 7) and the step shown in Figure 20 (and corresponding to the prior art second forming step shown in figure 8). In this additional forming step shown in Figures 17 and 19, a second forming tool 43 is pressed in a stamping action onto the inner side of the bent profile strip. As can be seen from the perspective view in Figure 18, the second forming tool 43 has on its top

side an upwardly protruding head part 44, which is laterally joined by two lower-lining circular, arc-shaped shoulders 47, 48. The radius of the shoulders 47, 48 equates to the radius of the opening in the cam enclosing the shaft.

By means of the head part 44 of the second forming tool 43, an indentation 45 (see Figures 20-23) is created in the region of the later elevation 49 of the cam. As a result of the indentation 45, cam material of volume V3 - as can be seen from the cam cross-section represented in Figure 24 - is displaced outward and is there heaped up to form walls of volumes V1 and V2. In the radially inward direction, these walls are delimited in the forming process by the shoulders 47, 48 of the second forming tool 43. In this way, at the sides of the cam, the cavity 33 shown in Figure 11 is closed. By virtue of the heaped walls, the cam is mechanically stabilized in the region of the elevation 49. At the same time, in the marginal regions of the cam, an angle of enclosure of full 360° is achieved, which angle means an advantageous improvement in the non-positive and positive connection between shaft and cam.

The inventive features of the method according to the present invention are the features substantially as contained in original claims 20 and 21.

Claim Rejections - 35 U.S.C. § 103

Claims 3-6, 8, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mertz in view of Umezawa et al. (5,598,631). This rejection is traversed for at least the following reasons.

The Examiner admits that Mertz fails to disclose, the shaft, in the sections in which the cams are placed, has an enlarged external diameter, circumferential beads are incorporated in the shaft, the associated cam is subsequently slid onto this section of the shaft. The Examiner admits that Mertz does not disclose a tight connection, or cams that have on the inner side of the ring a means for creating a positive connection to the shaft, or circumferential beads that are created on the shaft by a rolling operation.

The Examiner looks to Umezawa for such teaching. However, the multi-step forming process is not taught or suggested in Umezawa.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mertz in view of Rowell (4,233,832). This rejection is traversed for at least the following reasons.

The Examiner admits that Mertz fails to disclose, the profile strips are created from a round wire by forming methods, in particular by rolling methods. The Examiner looks to Rowell for such teaching. However, the multi-step forming process, which is missing from Merz, also is not taught or suggested in Rowell.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mertz in view of Hiraoka et al. (4,969,262).

The Examiner admits that Mertz fails to disclose the cams are produced from a profile strip which has two layers of different material lying one above the other. The Examiner looks to Hiraoka et al for such teaching. However, the multi-step forming process, which is missing from Merz, also is not taught or suggested in Hiraoka et al.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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